SCIENCE

A WEEKLY NEWSPAPER OF ALL THE ARTS AND SCIENCES.

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SCIENCE

NEW YORK, APRIL 15, 1892.

A NEW PATENT OFFICE.

In our issues of Jan. 29 and April 1, attention was called to the needs of the Patent Office and the great injustice which was persistently maintained against inventors, the public, the nation as a whole, and the official staff of the Patent Office by the criminal over-crowding of that office consequent upon the insufficient space assigned it in its own building, by the shameful absence of provision for ventilation, and, not least, by the introduction of the offices of the Interior Department into a building erected with the money of inventors taxed heavily for the privilege of giving a wealth and a prosperity to their country, far beyond anything seen elsewhere in the world.

We now observe that the daily papers report that on the 7th instant Senator Falkner introduced a bill, not to give the Patent Office the control of its own building and to appropriate the $4,000,000 or so much as may be needed of it to the extension and improvement of that building, *but* to erect a new building. The cost is not to exceed $3,500,000, and $500,000 is appropriated to begin the work. In other words, this proposition—it may never be more—is to give to the Interior Department a building erected at a cost of $3,000,000 by the inventors of the country, mostly poor men struggling against every misfortune, and *then* to take an additional $3,500,000, also contributed by these needy inventors for the privilege of making their country and its already wealthy men still wealthier, and appropriating *that* to the construction of *another* building for the Patent Office. In other words still, it is proposed to take of the $7,000,000 which we have, in the course of the century, forcibly wrenched from the almost empty purses of our thousands of talented but needy inventors as a tax upon them for enriching their country, one-half the whole for the construction of a building that it is a disgrace to the nation not to have given them long ago, and to give the other half to a Department which has absolutely no claim upon it, which has been an incubus upon the work of the Patent Office for years, and which is to-day through the exercise of technical legal power and in defiance of justice and public policy, a "squatter" on the territory of the Patent Office and a nuisance there. It seems remarkable that this should be possible, in the face of justice and in spite of the united power of all the inventors in the land, of all their representatives, and of all the members of the legal profession who are daily earning their fees by doing the business of these wronged inventors. The whole matter is a standing disgrace to the country and our representatives in Congress, and a crying injustice to the men who have built up the whole modern system of production of the United States.

The *Scientific American*, referring to proposed legislation by which it is provided that foreign inventors shall be taxed the same amount in this country as in their own for such protection, says:—

"The theory upon which we grant patents and the object of our patent laws is the promotion of useful arts and industries, not the taxation of inventors. The aim of our patent laws is to encourage the study and development of new inventions, whereby multiplied and diversified forms of novel industries are made accessible to the people; for by industries they thrive. The American law as it stands invites inventors throughout the world to bring hither their new inventions and set up their new industries. In reward for so doing it grants them a patent for seventeen years, after which the invention becomes free to the public. The larger the number of patents granted, the greater will be the number of new industries established, and our measure of prosperity will be correspondingly increased. As a people we have everything to gain and nothing to lose by encouraging inventors, no matter where they live or where they were born."

It is in this, as we consider it, correct theory of the patent system that all our legislative action and every policy relative to patents should be determined. Make the patent-fees as small as is practicable; stimulate inventors to bring out their inventions; insure the most complete and perfect protection; and give the inventor at least the full worth of his money. It is scandalous and disgraceful to tax a poor man for the privilege of promoting the best interests of his country. Not one inventor in thousands acquires a competence; but the inventions of these very men make the nation and its capitalists rich. If the whole $7,000,000 contributed by them to the Patent Office treasury is needed to insure this they should have it—and ten times more if good use can be made of it.

OBSERVATIONS ON THE GROWTH AND CHEMICAL COMPOSITION OF THE MAIZE (CORN) PLANT.

June 12, 1891, seventy-five hills were selected in a field of Leaming corn planted May 15. Each hill contained three corn plants, and they were as nearly uniform in appearance as could be found in the field. The seventy-five hills were divided into fifteen lots, each lot containing five hills. Beginning June 12, and every week thereafter during the season, the plants in four hills of corn in one plat were cut close to the ground. The plants from one of these hills were dried and preserved. A chemical analysis was made of the plants from each of the remaining three hills, so that during the growing season these analyses were made of triplicate samples taken each week. The fifth hill of corn in each lot was left to grow, and was measured each week during the season. Each corn plant in the seventy-five hills was measured every week until it was cut. These measurements included the height to the tip of the upstretched longest leaf and also to the tip of the tassel when it was present, making a total of 3,159 measurements.

The soil in which the corn was grown was very uniform prairie land, located in central Illinois. The season was below the average for corn-growing because of the drouth.

Like almost everything else that grows, the plants did not all make the same amount of growth in height each week. There was quite a variation in the growth of the different

stalks, the maximum height being reached about Aug. 1; but, as will be seen further on, the plants had acquired at that time less than one-half of their total dry matter.

A condensed summary of some of the observations made is given in the following table:—

Week Ending.	Number of Plants Measured.	Height of Plants (inches). Extremes	Height of Plants (inches). Average.	Field-Notes.	Dry Matter per Plant (grams).	Rainfall (inches).	Average Daily Temperature, Fahr. Mean.	Maximum.	Minimum.	Percentage Composition of Dry Matter. Ash.	Protein.	Crude Fibre.	Nitrogen Free Extract.	Ether Extract.
June 12	25	11-26	16			.48	66	76	55					
19	225	23-43	31		4.5	.30	75	90	62	11.2	27.5	23.3	35.7	2.2
26	213	32-64	47		19.9	1.20	75	86	60	11.8	24.1	25.4	36.7	1.9
July 3	201	50-84	65		30.4	.03	72	85	58	11.5	19.1	18.1	39.4	1.9
10	189	57-91	73		50.0	.07	68	81	51	10.5	19.1	29.2	39.5	1.6
17	177	59-102	84		114.2	.47	72	86	57	8.9	15.7	30.6	43.8	1.8
24	165	64-111	96	Full tassel.	161.5	.20	73	86	60	7.9	12.1	29.1	49.2	1.6
31	153	81-115	98	Silks alone.	161.2	.67	68	80	54	7.1	11.3	28.1	51.0	2.4
Aug. 7	141	82-116	98	Pollen shed. Silks dead.	215.1	.01	71	87	55	6.0	10.8	26.7	54.6	1.8
14	129	82-118	98		200.0	1.35	74	94	60	6.8	10.8	29.5	51.2	1.5
21	117	92-118	97	Roasting ear stage.	256.0	1.28	75	86	67	6.2	10.3	27.5	53.9	2.0
28	105	82-115	97	Corn denting.	294.9	.13	62	74	50	5.7	9.3	24.7	57.5	2.6
Sept. 4	93	81-114	97	Husks turning brown.	349.5	.34	63	77	49	5.1	8.5	21.7	61.7	2.9
11	81	81-114	96		319.7	0	69	76	46	5.0	8.9	20.4	62.8	3.0
18	69	81-113	93	Husks dry. 50% leaves dead.	290.0	.0	73	90	57	5.2	9.7	19.7	62.5	2.8

The figures giving the grams of dry matter per plant and the composition of the dry matter represent an average per plant of the nine analyzed each week, or three hills of corn, each containing three plants. No attempt was made to separate the different parts for analysis, such as the ear, stalk, and leaves, but that part above ground was taken as one plant.

The rainfall during the season was considerably below the average, and is here given in inches:—

Average.	June.	July.	August.	September.
For ten years.	5.04	2.75	3.45	3.27
For 1891.	2.08	1.41	2.86	0.41

The record shows that the average maximum height per plant was attained during the week ending July 31; but it contained at that time only 46 per cent of the maximum quantity of dry matter.

The growth in dry matter continued till Sept. 4, and the decrease after that date probably was due to breaking off and blowing away of dry or dead portions of the leaves.

Assuming the total height per plant to be 100 inches and that it was 19 inches high June 12, or 19 per cent of its total height, also that the maximum growth in weight was 350 grams of dry matter, the percentage of the total height and weight attained each week is as follows:—

	June 12	19	26	July 3	10	17	24	31	Aug. 7	14	21	28	Sept. 4	
Height.	19	13	17	19	9	10	11	2 = 100 total.						
Weight of Dry Matter.		1.3	4.6	3.2	5.8	18.5	12	0	15.6	0	11.9	11.3	15.8	= 100 total.

The omission of two weeks in the record where no increase in dry matter was found is caused by the fact that we cannot have the plant and analyze it too.

During the week ending Aug. 14 the record shows that for this season an unusually large quantity of rain had fallen, and the plants which were analyzed that week showed a smaller quantity of dry matter than those of the week before.

The analyses of the dry matter show that 100 pounds of the corn plant has quite a different composition at the various stages of its growth. The percents of ash, or mineral matter, and also of protein are highest when the plant is young, and these decrease with age; while the nitrogen-free extract, or carbo-hydrates, increases in percentage as the plant matures.

Assuming that there are 10,000 corn plants per acre, which number it has been found is a fair estimate of the thickness of planting in Illinois, these analyses show that an acre of corn grown to maturity contains 7,716 pounds of dry matter, and this dry matter is composed of 394 pounds of ash, or mineral matter, 656 pounds of protein, and 6,666 pounds of carbo-hydrates.

E. H. FARRINGTON.
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Champaign, Ill.

THE TOMB OF KING AMENHOTEP.

THE tomb of King Amenhotep IV. has at last been brought to light in the nekropolis of Tel-el-Amarna in middle Egypt.

Since the close of the year 1890 the direction of explorations in Egypt has been occupied in clearing the two most important groups of graves in the neighborhood of this site, which belonged to the eighteenth dynasty, and many tombs have already emerged from the heaps of *debris* under which

they lay concealed, and their entrance had been protected with iron doors.

One of these, No. 25 on the plan, has at last been identified as the long looked-for hypogeum of the king. The main entrance-passage, cut into the mountain to a depth of fifty metres, opens into a chamber supported by four pillars. To the right of this passage, another corridor, forty-five metres long, branches out, opening into an unfinished chamber thought to be that of the queen. Somewhat further, on the same side, are three chambers, two of which are decorated with paintings; and among these occurs the name of the young princess Aten-Macht, the second daughter of Amenhotep IV. The decorations on the walls of the king's chamber represent him surrounded by his family, in adoration before the sun. The condition of the tomb when found showed it to have been disturbed in ancient times, a fact for which the circumstances of this reign furnish abundant explanation.

Until 1887 all that was known of Amenhotep IV. was that he peacefully succeeded his great father, Amenhotep III., whose queen was a foreigner; but that having selected for his only god the life and light-giving sun-disk "Aten," and having attempted to establish his worship to the exclusion of that of other gods, and particularly of that of Amon, he antagonized the arrogant priesthood, whose growing power was already then a force that the Pharaohs must count with. In consequence of this, he found it expedient to leave Thebes and to remove his court and the seat of government to middle Egypt, where, at some seventy-five kilometres south of Minieh, he founded the new city, "Khu-n-aten," i.e., Splendor of the Disk, the site of which is now known as Tel-el-Amarna.

Consistent in his unconpromising hatred of Amon and his priests, he changed his own name in which that of the now discarded god of his fathers entered as an element, and was henceforth called "Khu-n-aten."

He seems to have been a devoted husband and father, and the worship he introduced — and which, after all, was but a return to ancient sun-worship, and therefore more of a reform than an innovation — seems to have been a lofty one, if one may judge from the aspirations kindled by it in the souls of its worshippers, as expressed in the beautiful hymns that have come down to us.

Khu-n-aten left only daughters. At his death his sons-in-law, who succeeded him, had not the strength to continue the struggle; they gradually abandoned his faith to return to the old popular worship, and the eighteenth dynasty closed with a period of disturbance, indicated by the shortness of the reigns.

Was Khu-n-ated only a religious reformer, a mere fanatical monotheist, who, as has so often been stated, was urged by a devout foreign mother to break with the traditions of his father's race, and whose blind intolerance tried to enforce his own views upon his people? or was he a shrewd, far-sighted prince, who, perceiving the danger to the royal power lurking behind the increasing pretentions of the Theban priesthood, sought to put a check upon their encroachments and to insure the independence of the crown by removing the court and by surrounding himself with foreigners, thus defying this formidable caste?

The latter view receives support from the fact that it is against Amon alone that the king's animosity was practically directed, and that, whilst the worship of the disk was the official religion of the capital, the names of the other divinities of Egypt remained undisturbed upon the monuments of his reign, and Amon's name alone was everywhere erased.

In 1887 the discovery of the archives of Khu-n-aten, consisting of some three hundred cuneiform tablets, containing important correspondence between Egypt and its Asiatic allies and tributaries, as well as official reports from royal lieutenants in foreign lands, threw a most unexpected light upon the condition of the ancient civilized world in the fifteenth century B.C. Among the many interesting glimpses thus obtained is a mention of Canaan in pre-Exodus times, found in a letter from the tributary king of Jerusalem, which reveals the existence of that city at that remote period.

The fact that the correspondence between Asia and Egypt was conducted in the Neo-Babylonian characters was alone sufficiently extraordinary to draw the attention of the learned world to Tel-el-Amarna and to the remarkable figure of the man who, in his day, filled not only that spot, but no doubt the whole civilized world, with his strong personality. There are many peculiarities connected with the monuments of his reign and with the art they betray that have never yet been quite satisfactorily explained; and despite all that has been written, and the ingenious theories that have been advanced on the subject, there still remains enough that is hypothetical to make any monumental discovery connected with this period of the greatest interest to scholars.

S. Y. STEVENSON.

A SIMPLE APPARATUS FOR THE PRODUCTION OF LISSAJOU'S CURVES.

THE requisites are a piece of thin glass tube or rod, a gas flame, and a slight knowledge of elementary glass working. The apparatus consists of a short piece of rod or tube which serves as a base or handle, to which is fused a glass thread ten or fifteen centimetres long and from one-half to one millimetre thick, carrying at its extremity a second and much thinner thread of about the same length, whose free end is fused into a small clear bead. Both threads are in the same line with the handle, and the whole forms a compound rod.

In constructing this rod, two glass threads of the kind already indicated are selected rather longer than required. They are fused together, and the connection straightened by a gentle pull while still soft. The double rod is then held near its centre, and the finer thread shortened until in vibration it appears, by persistance of the visual impression, as a sheet or cone. The thicker thread is next adjusted in the same way until the vibration of this double rod, when held by its thicker end, is sufficiently rapid. This thicker end is now attached to a larger piece of glass (the handle), and a very small bead formed at the other end. The exact position and weight of the bead required to form any given set of curves must be found by trial.

Now, holding the bead in a strong light, stand nearly facing the light, but so as to see the bead with a dark background, and tap the handle lightly with the finger-tips. If the adjustment is perfect, the bead will appear transformed into a shining curve, oscillating or rolling and twisting upon itself with inimitable grace like a living thing, and dying away with the decreasing amplitude of the vibrations.

These curves are represented approximately by the equations: —

$$x = a \cos m\theta$$
$$y = b \sin (n\theta + \alpha),$$

where a and b are the amplitudes, α is the phase-difference, and the ratio $m : n$ is a function of the time. When the

ratio $m : n$ can be expressed by small integers the curve is completely shown by this apparatus. When this ratio cannot be expressed by small, but can by moderate, whole numbers, the curve cannot well be seen, but may be readily photographed. The most beautiful effects are seen when the ratio $m : n$ has almost some such values as 1:1, 1:2, 2:3, or 3:1. The values of a, b, and α vary with every tap of the finger, and thus a single apparatus will show a great variety of curves of one class.

I have not tried projecting these curves with a lantern, but I see no difficulty in the way of such a proceeding.

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VALUABLE EXPERIMENTS IN VEIN-FORMATION.

In No. 3, Vol. XII., of the *School of Mines Quarterly* there appeared a short paper "On the Genesis of Ore-Deposits," by W. H. von Streeruwitz, the chief of the Western Division of the State Geological Survey of Texas.

In these days of hasty conclusions and the overcrowding of scientific literature with opinions and half-developed theories, it is refreshing to run across an occasional example of undue modesty in presenting the results of elaborate experimentation. My excuse for thus tardily calling attention to a marked case of this character, entirely without the knowledge of the author, is the conviction that the gentleman himself will not lay claim to full credit for the work which he has planned and executed in a thoroughly scientific manner. Especially does this action seem fitting as preliminary to an extension of the same investigations by the present writer in the metallurgic laboratory of the Arizona School of Mines. In fact, it is only just to confess that the inspiration of these last experiments, for which preparations are now being made, came originally and wholly from the most interesting results of Professor von Streeruwitz's patient and intelligent observations in his laboratory at Houston, Texas.

In the paper quoted Professor von Streeruwitz does not make very clear how much of the value of his well-fortified conclusions rests upon the skill with which he has himself conceived and executed a most convincing series of experiments. But those who have seen some of the tubes with miniature veins of gold, silver, copper, lead, etc., and others with beautifully formed agates, need only the concise reasoning of the article referred to, in order to understand the originality, perseverance, and devotion to truth with which the investigation has been carried out through several years of diligent experimentation.

In the language of our author, the experiments would, so far, appear to establish the following points, viz.: —

1. It is principally the iron which, in silico-ferruginous fissure veins, brought the other metals from greater to (by mining) accessible depths.

2. Most siliceous ore-leads, carrying also large quantities of iron and having silico-ferruginous outcrops, seem to be deposited from hot aqueous solutions of the metals and silicates.

3. Metals and metal combinations contained in the rock surrounding the fissures and crevices were probably leached out by the hot liquids contained in the fissures and precipitated on and combined with the siliceous iron growing up in the fissures.

4. The fissures could be charged with ore-veins in a comparatively short time, since, no doubt, high temperature and galvanic currents existed in the fissures at the time of formation of the ore-gangues.

5. In contact-gangues the precipitation and deposition of ores was materially facilitated by galvanic currents caused by the contact of different rocks, and it is owing to the prevalence of galvanic currents that in most cases richer deposits at the intersection of two or more leads were formed.

6. The so-called iron outblows ("gossan," "eiserner hut," "Pacos," "Colorados," etc.) are frequently not the product of igneous eruption, but a deposition product from aqueous solutions; and alterations in the rocks contiguous to such outblows are not necessarily the result of eruptive agencies, but of a leaching process.

7. The formation of banded agates does not always take place, as is generally believed, in the cavities of a rock, but can also occur free in solutions; and the thickness of the bands progresses from the centre outwards, although a reverse process by osmosis may be possible under certain conditions.

The bases for these conclusions are somewhat more explicit than might, perhaps, be inferred from a reading of Professor von Streeruwitz's paper alone, but, as he is most careful to insist, the experiments possess their greatest scientific importance in the element of suggestiveness for future inquiry. It is remarkable that so little has heretofore been done in such directions; and, like the admirable flexure tests of the United States Geological Survey in orographic work, they point out little-trodden fields in geology which offer rich rewards to capable investigators who will approach the problems in inductive experimental mood, following the guidance of results as they are gradually manifested.

No one will be better pleased than Professor Streeruwitz to know that others are earnestly engaged in this study. The incidental discoveries, whatever they may be, are liable to prove as interesting and valuable as any which may be directly sought. Indeed, it is impossible at this juncture to predict to what legitimate length the investigation may lead.

The main thing to be desired is the inauguration of a large number of experiments with as widely varied conditions as possible of material, situation, environment, and activity. While co-operation is not really essential, it can do no harm and may result most beneficially. May not some of our zealous young geologists be induced to undertake this work, which should be continued with constant observation for a term of years?

Instruction will gladly be given to any who may require it, and from those who cannot otherwise aid the cause thoughtful suggestions will be most welcome.

Theo. B. Comstock.
Director School of Mines, Tucson, Arizona.

ROYAL METEOROLOGICAL SOCIETY.

At the meeting of this society on Wednesday evening, March 16, Dr. C. Theodore Williams, the president, delivered an address on the "Value of Meteorological Instruments in the Selection of Health Resorts." He drew attention to thermometers, maximum and minimum, as the foundation-stone on which medical climatology rests, and instanced effects of extreme cold or heat on the human organism. The direct rays of the sun are of the greatest importance, and in health resorts should be utilized to the full; in fact, only climates where, during the winter months, even a delicate person can lie or sit for several hours a day basking in the sunshine are to be recommended for most complaints, and the various forms of sunshine recorders are used to aid the medical adviser in choice of such health stations.

After referring to the value of rain-gauges, hygrometers, and barometers, Dr. Williams stated that many health resorts owe their reputation almost solely to their shelter from cold winds; for

instance, the advantage in climate which Hyeres and Mentone enjoy over Marseilles is chiefly due to their being more sheltered from the mistral, or north-west wind, the scourge of the lower valley of the Rhone from Valence to Avignon. He went on to describe the climate of the Riviera, illustrating it by lantern slides from recent photographs, including views of Hyeres, Costabella, Cannes, Nice, Mentone, San Remo, etc., and he showed the three principal causes of the warm winter in this region to be: (1) the southern latitude; (2) the protection from cold winds by mountain ranges; and (3) the equalizing and warming influence of the Mediterranean Sea, which being practically tideless is always equally potent, not varying with hour and season. Dr. Williams mentioned the weak points of the south-of-France climate, with its blustering mistral, its occasional cold bise, its moist sirocco-wind; but summed up the Riviera winter climate as being, on the whole, clear, bright, and dry, with fog and mist practically unknown, with a winter temperature of 8° to 10° higher than England has, though subject to considerable nocturnal radiation, with about half the number of rainy days and four to five the number of bright ones which she can boast of, with cold winds and cold weather, without which it would lose its health-giving effect.

After the delivery of this address the meeting was adjourned in order to allow the fellows and their friends an opportunity to inspect the exhibition of instruments relating to climatology which had been arranged in the rooms of the Institution of Civil Engineers, 25 Great George Street. The Meteorological Office showed a set of instruments necessary for the equipment of a climatological station, viz., Stevenson thermometer-screen, fitted with dry-bulb, wet-bulb, maximum and minimum thermometers; and also a rain-gauge. Thermometers were also shown for ascertaining the temperatures on the ground, under the ground, and at a distance, as well as for recording temperature continuously. Various forms of sunshine recorders were exhibited, as well as a number of actinometers and solar radiation instruments for ascertaining the heating effect of the solar rays. The exhibition included a large and interesting collection of hygrometers, also several rain-gauges and other instruments. Among the curiosities is a piece of plate glass which was "starred" during a thunder-storm on Aug. 21, 1879; this was not broken, but it has a number of wavy, hair-like lines. The exhibition contains a large number beautiful photographs of clouds, lightning, and snow-scenes, as well as of the damage done by the destructive tornado at Lawrence, Mass., U.S.A.

NOTES AND NEWS.

ON April 16, at the Department of Archæology and Palæontology of the University of Pennsylvania, will take place the opening of the Loan Collection of Objects used in Worship, already referred to in these columns.

— A very intense light, such as is required for photographic or occasionally for medical purposes, may, as is well known, be readily obtained by burning magnesium ribbon, which has, however, the disadvantage of being somewhat expensive. An excellent substitute, according to *Lancet*, has been found by a French chemist, M. Villon, in aluminium, which is about a third of the price of magnesium, and which may be utilized in the same manner by burning it in a spirit lamp, or, if a flame of much more intense brilliancy is required, in a coal, gas, or spirit flame supplied with a jet of oxygen. In these it burns without emitting fumes, in which respect it is superior to magnesium. The light given by aluminium has a high actinic power — nearly as high, indeed, as that of magnesium. The most convenient way of obtaining a very intense light, according to M. Villon, is to use a lamp provided with a jet of oxygen at the centre of its flame, into which powdered aluminium mixed with a quarter of its weight of lycopodium and a twentieth of its weight of nitrate of ammonium can be projected by means of a tube furnished with an air-ball. This gives an exceedingly intense light, without smoke. A mixture of aluminium powder with chlorate of potash and sugar can be ignited, giving an intense light by means of gun-cotton, but is somewhat dangerous. Probably the best plan for medical photography, or for laryngoscopic and auroscopic and other demonstrations, would be to burn a ribbon of aluminium in an ordinary spirit lamp. Of course, if oxygen and an oxy-hydrogen, or an oxy-alcoholic, lamp were at hand a much more intense light could be obtained.

— The London *Times* of March 24 printed the following communication from a correspondent: Under the direction of the Austrian Government an interesting series of deep-sea explorations has been conducted recently in the eastern parts of the Mediterranean, by a scientific party on board the "Pola." At one point, about 50 nautical miles south-west from Cape Matapan, the "Pola" found a depth of 4,400 metres (2,406 fathoms), followed within a few miles further east by a depth of 4,080 metres (2,236 fathoms), which are the greatest depths recorded in the Mediterranean. They have received from the Austrian Hydrographical Board the name of Pola Deep. The great depression of the Mediterranean must thus be shifted considerably east from its former central position on the maps. Another deep area was explored between Candia and Alexandria—the depths attaining from 3,310 metres (1810 fathoms) some twenty miles south-east of Grandes Bay, and from 2,392 metres (1,208 fathoms) to 2,120 metres (1,332 fathoms) within a short distance from Alexandria; the maximum depth sounded being 3,068 metres (1,678 fathoms) in 38° 39′ 30″ north latitude, and 33° 19′ 54″ east longitude. The highest temperature was found during the first part of the voyage, at depths of 1 to 50 metres, the highest being 60.8° Fahrenheit at 1 metre; the lowest temperature, 53½°, was observed at the issue from the Adriatic Sea, at a depth of 760 metres. In explorations conducted some two years ago in the Central Mediterranean, it was observed that the density of the water and its saturation with salt increased with depth, and the same was noticed in the western part of this year's cruise. But in the Eastern Mediterranean the density of water varies but very little in the different strata, and it is higher on the whole than in the west. The transparency of the water is very great in the Eastern Mediterranean. Altogether the "Pola" made no fewer than 50 deep sea soundings, 27 of which touched depths of more than 1,000 metres.

— P. Blakiston, Son, & Co., Philadelphia, announce that they will soon publish "Physical Education," by Frederick Treves, F.R.C.P. The subject of physical education as a hygienic measure has recently attracted so much attention from school boards, the medical profession, and sanitarians generally, that it now ranks in importance with the various branches of study pursued in our public schools and colleges. To the average city man or woman of sedentary occupation physical exercise is of quite as much consequence as it is to school children and college students. It is, however, often taken up unwisely and to the lasting harm of those who in ignorance attempt methods that are unsuited to their physical condition. It has therefore been thought advisable to publish, from the advance sheets of "A Treatise on Hygiene," this paper by one of the best known medical writers of the day, that it might be within the reach of those who would not perhaps care to purchase the larger work in which it will be included.

— Houghton, Mifflin & Co. announce that Mrs. Olive Thorne Miller adds to her two excellent books about birds already published by this firm a third, to which she gives the title, "Little Brothers of the Air." It describes between twenty and thirty different birds, and for all lovers of birds, who are happily very numerous, this little book has special attractions. Professor Child has prepared the eighth part of his remarkable edition of "English and Scottish Popular Ballads." It was originally expected that the work would be complete with the eighth part, but Professor Child has been successful in discovering a good deal of material which he had hardly anticipated finding, so that at least one more part is necessary to complete the work. "The Satchel Guide for the Vacation Tourist in Europe" has been revised for 1892, and, as heretofore, holds the first rank among Guides for those who wish to cover only a part of Europe, and make a tour instead of a thorough continued study of many places.

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THE EVOLUTION OF COMMERCE.[1]

For over three thousand years the great highway for commerce has been from India by the Persian Gulf and the Euphrates or by the Red Sea to the Mediterranean, and thence through the Mediterranean by Gibraltar to western and northern Europe, and, in our day, thence to America.

Along this route cities and nations have sprung up, increased in wealth and power, and passed away, giving place to other cities and nations further westward. These nations have been great carriers and distributors of minerals and goods, as well as capitalists and bankers, or carriers, bankers and manufacturers; in either case controlling the commerce of the world. This control has never for any long period been held by the same race, but has passed from one nation to another, always from the east toward the west.

The earliest highway of commerce was from India through the Persian Gulf, up the Euphrates to the Mediterranean; and carpets and precious stones were then as now carried over this route. Explorations and surveys for a railroad have been recently made along this "our future highway to India." Caravans brought spices from Arabia and rich stuffs from Babylon and Nineveh to the shore of the Red Sea. Solomon made a navy of ships and Hiram sent in the navy his "Servants, shipmen that had knowledge of the sea, and they brought gold from Ophir, great plenty of almug trees, and precious stones."

Tyre and Sidon founded colonies on the shores of the Mediterranean, enslaving the Spaniards and compelling them to work the mines of gold and silver already opened in Spain. Their ships sailed through the Mediterranean, by the Pillars of Hercules, into the Atlantic Ocean, turning northward to England for tin and copper and on into the Baltic Sea for furs and amber; turning southward along the western coast of Africa, passing certainly two thousand miles to the equator and probably rounding the Cape of Good Hope into the Indian Ocean. Products from the west were brought in ships to Tyre and Sidon and exchanged for the goods of the east, their merchants making profits on each transaction both as merchants and as carriers. Tyre and Sidon became wealthy, luxurious, and effeminate. Some of their citizens saw in Africa a richer soil and a better situation for a large city, and founded Carthage. The Carthaginians inherited the trade of Tyre and Sidon, and in addition opened highways to Egypt and into the interior of Africa, bartering their wares in Egypt for corn and grain and in Africa for ivory, gems, and slaves. They planted colonies in Africa and Sicily, and for a time were successful rivals of Greece and Rome.

The rule of the ocean transferred from Asia to Africa remained there but a short time, for the day of Europe came with the rise of Greece and Rome.

The Greeks founded colonies in Asia Minor, Sicily, and Italy. The ruins of great cities with Grecian temples and amphitheatres are found at Girgenti and Syracuse in Sicily, at Pæstum and other places in Italy. Under Pyrrhus, their armies were defeated by the Romans and their colonies captured. Deprived of these, their power rapidly declined and Greece became a Roman province.

Rome.

Rome founded few colonies, but she conquered the nations of Asia, Africa, and Europe, and brought under her sway cities, kingdoms, and empires. She boasted of five hundred cities in her Asiatic province that had been founded or enlarged and beautified by the Cæsars. One hundred and twenty vessels each year brought the goods of India from the delta of the Ganges, and large fleets from Egypt came laden with corn and grain. She imported from every country, but exported little, paying for her imports by taxes levied on her colonists.

Rome was the first power to incorporate conquered states into her dominion and extend citizenship to all the people in her empire; so that Paul could say in truth, "I am a Roman citizen and to Cæsar I appeal." So salutary and beneficial was her rule that under it these countries prospered more than under their own rulers. What Rome seized with strong hands she defended, and in return for taxation gave protection. She has no more enduring monuments than her roads, the remains of which are now found in every country of Europe. Though built as military and post-roads, they were used largely for commerce. All started from the golden mile-stone in the forum; one ran over the Brenner pass north-eastward to the Baltic Sea, another followed the north-western coast of the Mediterranean to Spain and southern France, another crossed the Alps and extended through France to the British Channel and through England to Scotland, where the Romans built a wall, ruins of which now bear witness to its strength. Another way went southward to Naples and Brindisi, and another led eastward to Macedonia and Greece. As these were the only roads in all these countries, it was truly said, "All ways lead to Rome;" and over them the messengers of Cæsar travelled more rapidly than the mail-carrier of our fathers on our mail-routes.

Venice and Genoa.

After five hundred years of empire Rome fell, and the Dark Ages followed. From A.D. 400 to A.D. 800 commerce and trade died out. The only vessels on the Mediterranean and Baltic were piratical crafts; Jerusalem and the Holy Land were captured by the Turks; the Crusades began, forerunners of a higher civilization and more extended commerce. Thousands and tens of thousands of people from all parts of Europe and all ranks of life, bearing the pilgrim's badge — the blood-red cross — journeyed toward the Holy Land, first in vast crowds led by Peter the Hermit, then in great armies led by kings and generals. For two hundred years this movement continued. Venice and Genoa furnished ships to carry the armies of France from Italy to the Holy Land. The Venetians were shrewd merchants and drove hard bargians, stipulating for cessions of land at the best commercial points and adequate compensation for their services. After the failure of each Crusade they brought back remnants of the troops and pilgrims, and with them the products of Asia Minor, and books and art treasures from Greece. These were distributed all over Italy, and led to the renaissance of the thirteenth and fourteenth centuries.

The trade with the East brought power and wealth to Venice

[1] Annual address by the president, Hon. Gardiner G. Hubbard. Presented to the National Geographic Society Jan. 15, 1892. Nat. Geog. Mag., Vol. IV., 1892.

and Genoa. They founded colonies on the Black Sea, in Asia Minor, and on the Asiatic coast. Venice alone had three thousand merchant vessels. Their commerce was not confined to the borders of the Mediterranean, for the goods of the Orient were distributed by the way of Augsburg and Nuremberg to the interior of Germany and to the towns of the Hanseatic Confederation. Thus commerce was opened with the interior of Europe.

By the failure of the Crusades, the power of the Turks, which had been for the time checked, grew and increased. They conquered the holy places of the earth, Asia Minor and Syria, and finally, crossing into Europe, gained Constantinople. The colonies of Venice and Genoa were captured; their fleets disappeared from the Mediterranean. In western Europe the Spaniards under Ferdinand and Isabella conquered the Moors, who for many ages had occupied the larger portion of Spain; and as the Crescent appeared in eastern Europe, the Cross triumphed in the west.

Spain and Portugal.

Then a new power appeared upon the stage. Spain and Portugal entered upon an era of exploration and discovery in regions unknown to Venice and Genoa. Commerce, which in the Middle Ages had been confined to the Mediterranean Sea, was now extended to the countries on the Atlantic Ocean, and the Cape Verde Islands, Madeira, and the Canaries were discovered. In one generation (between 1470 and 1500 A.D.) more and greater discoveries were made than in any other period of the world's history. The Portuguese sailed along the eastern coast of Africa and rounded the Cape of Good Hope; Vasco de Gama crossed the Indian Ocean to India; Columbus sailed westward to find the Orient, and discovered a New World; Magellan circumnavigated the globe; Balboa crossed the Isthmus of Panama and was the first to see, on the same day, the sun rise out of the Atlantic and set in the Pacific; and soon the eastern and western coasts of America were explored from Newfoundland to Cape Horn and from Cape Horn to Panama.

Both Portugal and Spain claimed all the New World, and as they could not agree upon a division of territory they referred the matter to the pope, who divided the New World between them. The Atlantic became the great highway for commerce, while the Mediterranean was deserted, and Venice and Genoa existed only in the past.

The commerce of Portugal was coextensive with her dominion, which extended from Japan and the Spice Islands and India to the Red Sea, thence to the Cape of Good Hope; and with their possessions on the eastern and western shores of the Atlantic and in Africa and Brazil completed their maritime empire, the most extensive the world has ever seen. Then a single fleet of one hundred and fifty to two hundred and fifty caracks sailed from the port of Goa to Lisbon; now there sails but one vessel a year from all India.

From Spain ships sailed both to the Caribbean Sea and to Cape Horn and thence to Chile and Peru, or directly north-westward from Cape Horn to the Phillippine Islands. Spain conquered Mexico, Central America, and all South America except Brazil. The gold and silver of Peru and Chile and the goods of the Orient were brought to Spain and Portugal. As their wealth and power increased the spirit of exploration decreased, and for nearly two hundred years the Spanish ships sailed in a fixed course by the same lanes, exploring the ocean neither toward the north nor the south, leaving undiscovered the great continent of Australia and numerous groups of islands.

The Spanish and Portuguese leaders were cavaliers who despised all commerce excepting in gold and silver, all kinds of manufactures, all manual labor, and the cultivation of the ground; they came not to colonize, but to satisfy by the labor of the enslaved aborigines their thirst for gold and silver. The whole political power was retained by the king of Spain and administered by Spaniards. While the silver and gold of America and the wealth of the Indies poured into the treasuries of Spain they wanted nothing more. Like ancient Rome, they took all the wealth of the conquered countries, making no return; but they did not, like Rome, give wise and equitable laws and a stable government to the countries they conquered.

The Netherlands.

The inhabitants of the Netherlands were manufacturers, and supplied the markets of Spain and Portugal and their colonies, thus reaping as large profits from their trade with these countries as the Spanish and Portuguese from the mines of gold and silver.

No part of Europe, says Motley, seemed so unlikely to become the home of a great nation as the low country on the north-western coast of the continent, where the great rivers, the Rhine and Scheldt, emptied into the North Sea, and where it was hard to tell whether it was land or water. In this region, outcast of ocean and earth, a little nation wrested from both domains their richest treasures.

The commerce of the Hanseatic towns, which had depended for their trade on Venice and Genoa, became less and less as the glory of those cities waned. Antwerp, with its deep and convenient rivers, stretched its arms to the ocean and caught the golden harvest as it fell from its sister's grasp. No city, except Paris, surpassed it in population, none approached it in splendor. It became the commercial centre and banker of Europe; five thousand merchants daily assembled on its exchange; twenty-five hundred vessels were often seen at once in its harbor, and five hundred daily made their entrance into it. The manufactures of Flanders and the Netherlands had been noted for many generations, and now vastly increased and were distributed all over the world. The Netherlands, though the smallest, became the wealthiest nation of Europe. Then came the long-continued war with Spain, ending in the siege and fall of Antwerp and in the imposition of such taxation as no other country had ever endured. As Antwerp had grown on the ruins of the Hanseatic towns, so her fall became England's gain.

France and England.

In America, north of Mexico, neither silver nor gold had been found to tempt the Spanish and Portuguese. The larger portion of the northern Atlantic coast was one long sand beach, broken by great estuaries and the mouths of great rivers; the rest was rocky and rugged, the temperature generally cold, the land unfertile and barren. For these reasons North America was left to the French and English. The French claimed Canada and the whole of the territory of the United States save a narrow strip of land on the Atlantic coast. The French population was small and was made up principally of fur traders and half-breeds; Great Britain held New England, Virginia, and the Carolinas.

After the first fever of religious colonization had passed, about the commencement of the eighteenth century, there was scarcely any emigration from England to America and but little trade between the two countries. The population of North America was small, its commerce less, with little profit to the European merchants. The country possessed no peculiar advantages for the production of articles of value in foreign markets; there was nothing, therefore, to invite immigration or commerce.

The chief inducement to the English to navigate the Atlantic was the hope of capturing the treasure-laden Spanish galleons and the rich Spanish cities.

Sir Francis Drake, Sir Walter Raleigh, and other navigators, aided by Queen Elizabeth, with bands of buccaneers, refugees from all countries, though mostly Englishmen, explored the recesses of the Caribbean Sea, crossed the Isthmus of Panama, and launched their little vessels on the Pacific. In fifteen years they captured five hundred and forty-five treasure ships, sacked many towns, trained the English seamen, and laid the foundation for the navy of Great Britain.

The growth of English commerce was slower than that of Spain, Portugal or Holland, and it was not until the middle of the eighteenth century, or two hundred and fifty years after the discovery of America, that she entered upon that career which gave her the control of the ocean. Her commerce was built up by protective laws, founded on the Navigation Act of 1651, which prohibited foreign vessels from carrying to or from England the commerce of any country but its own. These laws were universally regarded as among the chief causes and most important bulwarks of the prosperity of Great Britain, and they were con-

tinued until English ships controlled the carrying trade of the world, and were not finally repealed until 1854.

The mechanical devices of Watt, Arkwright, and other great inventors gave to England that supremacy in manufactures which she has ever since retained. The French revolution a little later aroused the fear of the statesmen, merchants, and capitalists of England that the energy of the new republic would be as omnipotent in mercantile affairs as on the field of battle. They believed that France might regain the colonies and with them the commerce she had lost, and therefore England declared war against Napoleon, which was carried on almost continuously from 1793 to 1815. The shipping of the continent disappeared or was captured by the fleets of England; the colonies, and with them the commerce, of Spain and Portugal, Holland and France, passed to England; and though she is still burdened with the debt then created, she has never lost the commerce and carrying trade she then obtained.

The population of the colonies of Great Britain is about one-sixth of the entire population of the globe; and their territory comprises eighty per cent of the available temperate regions of the earth belonging to the Anglo-Saxon race.

The commerce of England has given wealth to her bankers and merchants, and employment to her artisans, ship-builders, iron-workers, miners and manufacturers. Her exports of produce and manufactures have increased five hundred per cent in fifty years, or from $256,000,000 in 1840 to $1,577,000,000 in 1890, and are carried by her ships to every quarter of the globe. Though dependent on America for her food supplies, these are moved in British ships. The commerce of the world pays tribute to the bankers of London and makes that city the money centre of the world. Her best market is India, and from India comes her largest imports; next to these from the United States.

India.

Egypt, Nineveh and Babylon in prehistoric times, Tyre and Sidon and Greece under Alexander, Carthage and Rome under the Cæsars, Venice and Genoa in the middle ages, Portugal and Holland, and lastly England, have drawn great stores of wealth from India.

From India science and literature were handed on to Europe, and from India has come the religion of more than half of the human race. For India the Spanish sailed westward; for India the Portuguese sailed eastward; Portugal was the first to reach the goal and obtain the prize. Greater riches have been drawn from India than from the gold and silver mines of America, since for all ages it has been the storehouse from which treasures were derived. Portugal held India from about 1500 to 1600. Ships brought the silks and precious stones of India to Lisbon, where they were sold to the Dutch and distributed by them through Europe. Spain conquered Portugal, and to avenge herself on Holland excluded her merchants from Lisbon. Then they sailed directly for India, dispossessed the Portuguese, and the commerce of India was for the next hundred years controlled by Holland.

Then for a short time India was divided between France and England, but under Lord Clive and Warren Hastings the possessions of France passed to the East India company, and when their charter expired it was made a province of the crown and the Queen of England became Empress of India.

Unlike Rome and Spain in their dealings with conquered nations, England gives a fair exchange for all she takes, and rules in India for India, giving a more stable and equitable government than India ever before enjoyed.

To-day Tyre, Sidon, and Carthage are known only by their ruins; the glory of Greece and Rome, of Venice and Genoa, has passed; the power of Spain and Portugal has waned, while India is developing a social, moral, and political prosperity, with wealth and commerce unknown in any former period of her history.

Suez Canal.

Much of the trade of India in ancient times passed through a canal connecting the Red Sea with the Mediterranean, the remains of which still exist, and efforts to reopen it have been made at different times by Egypt without success. In 1856 de Lesseps obtained concessions from the khedive for the Suez Canal, and commenced the work under the direction of the best engineers of Europe. De Lesseps applied to English capitalists for help, but they were deterred by Lord Palmerston, who said he "Would oppose the work to the very end." Mr. Stevenson, the engineer, supported Lord Palmerston, declaring that "The scheme was impracticable, except at an expense too great to warrant any expectation of returns." The emperor of France lent his name to the company, and large sums of money were raised in France; but the canal was constructed mainly by the money and laborers of Egypt. It was opened in 1869, and immediately English steamers began to sail through the canal, and the route around the Cape of Good Hope was almost abandoned. Other flags soon followed, and the commerce with India and the east, so long lost to Venice and the ports of the Mediterranean, was revived.

In 1875 Lord Beaconsfield purchased for England a controlling interest in the Suez Canal, and England now rules both Egypt and the canal. The vessels of all the maritime nations of the world are constantly passing through the canal, with the single exception of those of the United States.

Colonies.

The commerce of the great nations of the world has been principally with their colonies or dependencies, and from this commerce they have derived their wealth. The mother country in return for its real or nominal protection, and for its own aggrandizement, has restricted the commerce of her colonies.

The European nations adopted four classes of restrictions:—

1. Restricting the exportation of goods from the colony except to the mother country.

2. Restricting the importation of goods from foreign countries into the colonies.

3. Restricting the exportation or importation of goods excepting in ships of the mother country.

4. Restricting the manufacture even of their own raw products by the colonies. So strong was this feeling in England that even Lord Chatham declared in Parliament, "The British colonies of North America have no right to manufacture even a nail or a horseshoe."

Most of these restrictions have been removed, though the result still remains.

The Phœnicians, Carthaginians, and Greeks had colonies on the Mediterranean. The Romans conquered, and held as subjects, nations and empires. Venice and Genoa had colonies on the Black and Mediterranean seas. Spain and Portugal held as dependencies all Central America, South America, Africa, India, and the islands of the Pacific. The Dutch Republic and France planted colonies in India and America. England has colonies in every part of the world, and on her dominion the sun never sets.

Germany, France, Portugal, and Russia, appreciating the necessity of colonies for the extension of their commerce and for opening new markets for their manufactures, are planting colonies. France in Cochin China, Germany on the eastern and western coasts of Africa and the islands of the Pacific. Portugal, aroused to a new life, is determined to hold her remaining possessions in Africa; Russia is steadily adding to her dominion in Asia, and her railway from the Caspian Sea to Samarcand has opened in western and a part of central Asia a market for her manufactures and commerce hitherto supplied by Great Britain.

United States.

The United States is the only nation that has become great without colonies and without foreign commerce and shipping. Its vast extent of territory, where the east and west, the north and south, are separated more widely than the colonies of Tyre and Sidon or of Carthage and Rome from the mother countries; the great variety of climate, the fertile soil, its varied occupations and manufactures, and a widely distributed population, have created an enormous inland commerce and given that trade and wealth which other countries find in commerce and exchange with their colonies. Our population, wealth, internal commerce, exports and imports have increased at a more rapid rate than

those of any other nation in a similar period. This is not due in any great degree to immigration, for our population has increased in no greater ratio since this immigration commenced than before, and experts believe that it would have been as large and more homogeneous without immigration. We had at one time a large foreign commerce, and our merchants were the first to establish direct trade with China and the East Indies; the Stars and Stripes were seen floating on every sea and flying in every harbor, and for years we were the second maritime nation of the world.

The commerce of the world passed from wooden sailing ships to side-wheel steamers, to iron and then to steel propellers; England was a worker in iron and machinery of every kind, we were not. The civil war came and hastened the day which was sure to come. Our shipping faded away faster than it had arisen, while that of Great Britain increased as rapidly as ours decreased. This was not owing to a decrease of our foreign trade, for during the last twenty years our exports and imports have increased more than twice as rapidly as those of Great Britain.[1] Eighty-seven per cent of these exports and imports are carried in British ships, consigned to English houses which have been established in every large port in the world, and the proceeds are usually remitted to the London banker.

Fortunately, our flag never disappeared from our inland waters and from our coasting trade; for foreigners are excluded from the coasting trade, even where the ports are fifteen thousand miles apart by water.

The substitution of steamers for sailing ships and of steel for wooden propellers, which took place from ten to twenty years ago on the ocean, is now going rapidly on upon our lakes. Where in 1886 there were but six steel propellers, now there are sixty-eight; and of 2,225 vessels on the northern lakes, 1,153 are steamers, 902 are sailing vessels. The action of Congress in providing for the construction and equipment of war vessels by competition has led our ship-builders within the last eight years to establish ship-yards and machine shops where the largest ships can be built, and we are now building as large and fast vessels of war as England. Our ship-builders claim that they can construct ships equal in carrying capacity, speed and strength to those of Great Britain, and at no greater cost; though they cannot be run so cheaply because our sailors are better housed, fed and paid than those of other nations. The day will surely come when commerce will make her last movement westward, when America, lying between Europe and Asia, with her boundless mineral and agricultural resources, her manufacturing facilities, her extended sea-coasts, will be the foremost nation and New York the commercial capital of the world.

Nicaragua Canal.

From New York to San Francisco by land is about 3,000 miles, by water it is about 15,000 miles; yet, notwithstanding the greater distance, freight is constantly sent by water. From San Francisco it is about the same distance by water to either New York or London. If a waterway could be opened across the isthmus of Panama from one ocean to the other, the distance from New York to San Francisco would be diminished more than one-half, and San Francisco would be over 2,000 miles nearer New York than London. The first proposition for canals connecting the two oceans was made in 1550, suggesting two routes, by Panama and Nicaragua; and explorations and surveys of both have been frequently made, and various attempts made for their construction.

The success of the Suez Canal induced M. de Lesseps to undertake the connection of the two oceans by the construction of the Panama Canal, believing that the tonnage passing through it would equal that of the Suez Canal. This work has not been successful; the canal remains unfinished, with no prospects of completion.

Several hundred miles north of Panama is the lowest continental divide; 148 feet above tide-water on the Pacific slope of this divide is Lake Nicaragua, connected by the river San Juan with the Atlantic; up this river and through this lake, some thirty years ago, was one of the regular ways of intercommunication, both for freight and passengers, between New York and California.

The Maritime Canal Company and the Canal Construction Company, organized by Americans, have obtained concessions from Nicaragua, and have made surveys for canal, slack-water, and lake navigation from Greytown on the Atlantic through Lake Nicaragua to Brito on the Pacific, a distance of 170 miles. A harbor has been opened at Greytown and considerable work performed on the canal. The Panama route had the great advantage of an open channel from ocean to ocean, whereas the Nicaragua route requires several locks to cross the divide; but Brito is some six or seven hundred miles nearer California than Panama, a saving in distance that will compensate for the delay in locking. The opening of this canal will be the greatest benefit that could be conferred upon our commerce and shipping.

Freights by water between New York and California are now so high that a large portion goes by railroad. The effect that this canal should produce will be evident if we consider the great difference in expense between land and water carriage. Rail rates between New York and Chicago are a trifle over six mills per ton per mile, while the ocean rates on grain to Liverpool in 1888 were about half a mill per ton per mile; and one mill per ton per mile, or three dollars per ton from New York to Liverpool, is said to be a fair rate, while the all-rail rate between New York and San Francisco averages from forty to eighty dollars per ton, according to the class to which the freight belongs. It takes from seven to ten days to go from New York to Liverpool, twice as long from New York to San Francisco by rail, thirty days by Panama, and one hundred and twenty days by the all-water route around Cape Horn.

The opening of this canal will therefore reduce the freight on goods between the east and west at least three-fourths and possibly more. It will give us a free, easy, and cheap communication by water between the Eastern and Western States; our commerce will be built up, and the wealth and commerce of the Atlantic coast and the population of the States on the Pacific coast will be increased in a wonderful manner.

The opening of this route will give a demand for large steamships, and when we have such ships large ship-yards and machine-shops will spring up, and these alone are wanted to enable us to build and run ships on the Atlantic Ocean in competition with Great Britain. Then the prediction of Mr. Cramp will be fulfilled, that Englishmen will be asking one another, "Can we build ships as economically as they do in the United States?"

Modes of Conveyance.

The earliest transportation of merchandise was by caravans. The first caravan of which we have any certain account was that of the Ishmaelites and Moabites, who, while they were travelling from Gilead with their camels, bearing spices, balm, and myrrh to Egypt, bought Joseph of his brethren and sold him as a slave to Potiphar. These caravans were formed of merchants banded together for protection, under a guide and leader, sometimes numbering several hundred, with one thousand camels in a caravan. They travelled from seventeen to twenty miles a day, but only in the spring and autumn months. At night they stopped at caravansaries, where free lodging was furnished to men and beasts. In Turkistan and Arabia all trade and travel was by similar caravans until the railroad was opened across the desert by Merv and the Oxus to Samarcand.

Navigation was first by boat, and ages afterward by vessels. The earliest vessels of which we have any account were employed in carrying cattle down the Nile, and were propelled by sails and rowers. The vessels, at first small and with few rowers, were slowly increased in size and number of rowers until three, four, and even five banks of oars, one over the other, were used. They were often from 150 to 175 feet long, and from 18 to 26 feet in breadth, drawing from 10 to 12 feet of water, and sometimes carrying two hundred rowers and several hundred men. All these ships were without decks, whether sailing on the Mediterranean

[1] The exports of the United States have increased 118 per cent, the exports and imports 98 per cent; the exports of Great Britain 35 per cent, her exports and imports 37 per cent.

or Atlantic. They sailed by day, putting into harbor at night, and never losing sight of land unless driven by stress of weather. At first they sailed only with the wind, but by slow degrees they learned to tack; then decks were built over the stern and prow, leaving the mid-ships exposed to the high seas. This class of vessels, sometimes with banks of oars, continued until the middle of the last century. In the early part of the fifteenth century smaller but stronger vessels of better material were built for the voyages of discovery undertaken by the Portuguese. At this time also the mariner's compass was brought into general use, having been introduced from Arabia; eighty years later it found its way to England. Two of the vessels of Columbus were decked only at the prow and stern, and the three were manned by one hundred and twenty men.

The Armada of Queen Elizabeth was formed of merchant vessels fitted up as men of war, and not until the time of Charles the First were there any regular ships of war in England or, probably, in other countries.

Commerce was usually carried on by companies, with rules regulating the quantity of goods to be exported, so that the market should not be overstocked and unremunerative prices obtained. Sometimes the merchant was owner of the vessel, who adventured with his cargo and sailed in his own ship. The ships were constructed with little reference to speed, sailing forty or fifty miles a day.[1]

The steam engine came into use near the middle of the eighteenth century in England, and two generations passed before it was used on vessels. The first steamboat ran on the Hudson in 1807, in England in 1812. Then another generation passed before the ocean was crossed by the "Sirius" and "Great Western" in 1833. These ships sailed from seven to eight knots an hour. Ten years later iron ships were built; then came the propeller, the invention of Ericsson, followed by vessels built of steel, and lastly the "City of Paris" and "Majestic," carrying fifteen thousand tons of freight and sailing five hundred knots a day, or twenty knots an hour.

Until the present century all commerce between remote points was by water, excepting in the Roman Empire. After the downfall of Rome there was neither commerce nor travel and no use for roads, the cost of transportation even for a short distance exceeding the value of the goods.

The railroad was introduced about the same time into England and America, and was rapidly extended into every country. The steam-engine on land and water has revolutionized the methods of transportation and created a new commerce. "The movement of goods in a year on all the through routes of the world did not then equal the movement on a single one of our trunk lines of railroad for the same period." Formerly it cost ten dollars to move a ton of freight one hundred miles; now it can be moved thirteen hundred miles for the same sum. The grain and corn from our western lands, then not worth the transportation to the sea coast, are now sold in London, and our prairies yield to the western farmer greater profit than the grain lands of England yield to the farmer there. The land commerce created by steam probably exceeds to-day the commerce carried on the water.

The cost of moving freight by railroads varies greatly in different parts of the United States and in different countries. The highest cost west of the Rocky Mountains is two and a quarter times more than in some of our middle States. The average freight receipts per ton per mile in this country is $0.922, which is less than those of any other country, although the Belgian and Russian rates are not much higher. In England the rates are from fifty to seventy per cent higher than in America, and in the other countries of Europe higher than in England.

In England and America the railroads are operated by private companies in competition.

In France railroads are operated by private companies regulated by law, the country being divided among different lines of road. Lines are constructed by private companies and run at rates fixed by the government.

[1] The breadth was about one-fourth the length, and not until within forty years were the proportions of one-tenth or one-twelfth of the breadth obtained.

In Belgium and Germany the principal roads are owned and operated by the government.

Our system has yielded the best results to the people.

The commerce which was in olden times transported only twenty or twenty-five miles a day is now moved five hundred miles a day by water and eight hundred miles by land. Correspondence, then carried no faster than freight, is now borne by telegraph to the farthest ends of the world.

All these changes have taken place within a single generation; for our fathers could not travel any faster than Alexander or Cæsar. Steamships, railroads, and telegraphs within that time have transformed all commercial transactions and the methods of commercial business. Formerly eight months were required to execute an order in India or China and obtain the return; now one day is sufficient. These commercial changes caused a revolution in the modes of business, and were the main factors which produced the monetary disturbances of 1873, the effects of which we yet feel, so long has it taken the world to adjust itself to its new relations.

The Future of Commerce.

The commerce of the world originated in Asia; it was carried to Africa and thence to Europe, and from Europe to America. This movement can go no further westward, for on the other side of the Pacific is China, which has successfully resisted every attempt of the European to encroach upon her domains, and India with its teeming population of two hundred and fifty millions; so that America, the last of the continents to be inhabited, now receives the wealth of India and Asia pouring into it from the west, and the manufactures and population of Europe from the east. Here the East and West, different from each other in mental power and civilization, will meet, each alone incomplete, each essential to the fullest and most symmetrical development of the other. Here will be the great banking and commercial houses of the world, the centre of business, wealth, and population.

The end is not yet. Inventions are increasing in a geometric rather than an arithmetric progression. The limit of steam-power has not been reached, for with a high temperature in the steam-boiler the addition of a few pounds of coal increases the steam-power so greatly that we are unable either to control or to use it.

Electricity has just begun to offer new opportunities to commerce. We are no longer compelled to carry our factories to the water-power, for by the electric wire the power may be brought to the house of the operative, and we may again see the private workman supercede the factory operative. A few cars and small vessels are moved by electricity — the forerunner of greater things. We know little of this new agency, but its future growth must be more rapid and more wonderful than that of steam.

The secretary of the Smithsonian Institution (Mr. Langley) tells us that "before the incoming of the twentieth century, aerial navigation will be an established fact."

"The deeper the insight we obtain into the mysterious workings of nature's forces," says Siemens, "the more we are convinced that we are still standing in the vestibule of science; that an unexplored world still lies before us; and, however much we may discover, we know not whether mankind will ever arrive at a full knowledge of nature."

LETTERS TO THE EDITOR.

**** Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

On request in advance, one hundred copies of the number containing his communication will be furnished free to any correspondent.

The editor will be glad to publish any queries consonant with the character of the journal.

The Loup Rivers of Nebraska.

Perceiving by Professor Hicks's reply (March 4) to my comment (Feb. 19) on his essay on the Evolution of the Loup Rivers (Jan. 29) that I had in part misapprehended his meaning, I have corresponded with him in order to understand more clearly the share that he ascribes to headwater erosion and capture in the development of the present stream courses. As is not infrequently

the case, there is more agreement than difference in our discussion.

My misapprehension arose as follows: In his essay of Jan 29, after speaking of headwater erosion and the subsequent capture or lateral abstraction of certain streams by this process, Professor Hicks wrote, "The latest robbery in the Loup system is that of the headwaters of the Wood River. Journeying down from the headwaters of the South Loup, one is impressed with the apparent continuity of its valley with that of Wood River, rather than with that of the South Loup itself below Callaway. It is obviously an instance of the lower, more easterly stream cutting through the divide and drawing to itself the headwaters of the higher one. This series of captures by lower tributaries is exhibited on a grand scale and in a mature form in the Loup system."

If the reader will refer to the first figure in Professor Hicks's essay, he may understand why I inferred from this sentence that the several other deflected streams, exhibiting the same relative parts as shown in the South Loup and Wood Rivers, constituted the "series of captures" in which the South Loup was "the latest robbery."

It now appears, however, that the head of Wood River was not precisely located in the figure referred to; and that its correction by Professor Hicks in his letter to me places it more as figured by Professor Todd in *Science* for March 11. As thus figured, it is distinctly placed in another category from the streams deflected eastward by flood-plaining.

Professor Hicks refers me to his article on "An Old Lake Bottom" in the second volume of the Bulletin of the Geological Society of America. Mention is there made of certain old valleys of Tertiary erosion, more or less obscured but not entirely concealed by lake sediments of later Tertiary deposition, by which the country is now covered. These old valleys are placed in the same category with the abandoned channel at the head of the Wood River, by which the South Loup is supposed once to have flowed to the Wood, as if headwater erosion by adjacent streams had in all these cases determined the abandonment of the old valleys. But it is still not clear why all these abandoned valleys must be regarded as having lost their former streams by lateral abstraction following headwater erosion. I perceive that the slopes indicated in Professor Hicks's figures are in the proper direction for such abstraction; but it is surprising to find that slopes of so moderate a measure of inclination suffice to give one stream an advantage over another, even to the points of abstraction of this kind. I shall be delighted if this is proved to be the case; for, if so, the process of abstraction and the accompanying rearrangement of divides may be regarded as of very extensive application. As ordinarily explained, the advantage that the capturing stream must possess is much greater than would be found in a region of horizontal and comparatively weak sediments, and of moderate inclination, such as Nebraska.

I shall therefore hope to have a fuller discussion of the problem from Professor Hicks, and an exclusion of other processes as well as a confirmation of the effective action of headwater erosion on so large a scale in producing these changes in Nebraska river courses.

The chief rearrangement of the Loup streams, as shown in Professor Hicks's diagram, being the product of down-stream deflection of the tributaries of a flood-plained river, I find in them a very satisfactory justification of a somewhat hazardous explanation offered in an essay on the Rivers and Valleys of Pennsylvania (Nat. Geogr. Mag., I., 1889, 241) for the down-stream deflection of certain tributaries of the Susquehanna in the central portion of the State. But in this case the flood-plain, by whose growth the tributaries were deflected, is a thing of the imagination. If it ever existed, it has been entirely worn away by the denudation following the later elevation of the region in Tertiary time; the deflected streams, maintaining their specialized courses after uplift, cut down their channel through the imagined flood-plain sediments, and thus became superimposed on the underlying strata, which they now deeply dissect and traverse in a highly inconsequent manner. Professor Todd's diagram gives further illustration of this kind of down-stream deflection of tributaries. All of the branches of the Platte are deflected before reaching the main stream; the Platte itself is turned down before joining the Missouri; so is the Niobrara.

In this connection I wish to suggest another cause besides the three mentioned by Professor Todd for the north-eastward turn of the Platte at Kearney; namely, the possible spontaneous deflection of the river from its previous more direct course, as, for example, along the Little Blue, by its own action in building up the plain over which it flowed. The rivers of the plains of India frequently change their courses in this fashion; the Hwang-ho devastates the plains of China for the same reason. May not the Platte have once had the same shifty habit? The Garonne, in south-western France, is a still more striking example of a spontaneous avoidance of its former course. Much of the waste borne out from the Pyrenees by the Garonne and its fellows now forms a flat, delta-like surface, of radial slope from the point where the larger rivers issue from the mountains; but, instead of pursuing a direct course northward, the Garonne turns sharply to the east at the foot of the mountains; while numerous small streams run down the slope of the radial alluvial deposit. Perhaps in the same way the Little Blue and the branches of the Big Blue Rivers may represent the old courses of the Platte, abandoned for a newer course of lower grade.

There are two other questions that I should like to ask of western observers. Is there generally perceptible a right-handed deflection of the rivers on the plains, as if in consequence of the earth's rotation? Can examples be given of the lateral abstraction of one stream by another on a slope of planation, after the fashion described by Gilbert in his report on the Henry Mountains some years ago?

W. M. DAVIS.

Cambridge, Mass., April 7.

The Persistency of Family Traits.

THERE are one or two points bearing on the subject at the head of this article that were not mentioned by either of the writers in the issue of March 18. The first is that the mother in placental mammals tends to assimilate in respect to blood to the father, as the blood of the mother passes through the young *in utero* and therefore the strain of blood derived from the father is shared by the young with the mother. A study of family history carried on for almost twenty-five years shows that there is generally a running to what are called "family types" among the youngest of a numerous family, and the type is that of the paternal family. It is too well known to need argument that the mother frequently acquires diseases belonging to the father indirectly through the child she is carrying. It is also well known that an old couple tend to assimilate in facial and bodily appearance, and the change, as shown by numerous instances, is generally in the female, as the above facts would call for. We can see that each child in a family finds the mother more and more impregnated with the blood of the paternal house, and it is not strange if the children favor the family that gives them the name.

The other fact is that the pregnant mother is more readily influenced by whims than in any other state. From classical times to the present it has been the aim of those about a woman in such a state to make life as pleasant as possible. While we may no onger surround her with beautiful statues and other paraphernalia of a Roman household, we recognize that her whims may fix the character as well as permanently mark the coming child. We drive a gravid mare in a light wagon that the foal may be amenable to discipline. As the generality of married people associate more with the family that carries the name, it follows that the mother is affected by sympathy or antipathy for that family, and both lead her to dwell on the features and forms of its members, so that the child runs a good chance of bearing either or both. Birth-marks do not exist in fiction only, and though the bloody horse-shoe of Redgauntlet may be lacking, there are other signs to show the horror or antipathy of a terrified or whimsical mother. In a love match, the face of the father is reproduced, or, as the French proverb says, "The love child resembles the father." A union, therefore, of the two conditions noted above will cause the children to favor the race that carries the name rather than to run toward the spinster side, even were there nothing like reversions

to the primitive type, and as family portraits show a uniformity that could not exist if the race obtained but its mathematical proportion of ancestral peculiarities, arguments based on the mathematics of the case avail little in the discussion.

EDWARD H. WILLIAMS, JUN.

Bethlehem, Penn., April 9.

BOOK-REVIEWS.

The Great Earthquake of Japan, 1891. By PROFESSOR JOHN MILNE, F.R.S., and PROFESSOR W. K. BURTON, C.E. With plates, by K. Ogawa. Yokohama, 1892.

IN these modern days when photography has assumed such an important part, not only in the artistic side of life, but in the work of scientific observation as well, it was inevitable that after any great natural occurrence like the Japanese earthquake of October, 1891, the camera should be employed to assist in preserving a correct record of its effects. Some of the pictures so taken have been reproduced in the European and American illustrated papers and have aided much in conveying to western readers an idea of the great destruction caused by this calamity; but none which the writer has seen can be compared to the beautiful series of pictures contained in the volume named above.

It is an oblong quarto, 29 cm. by 41 cm. in size, containing twenty-nine full-page heliotype copies of photographs and one map. All but three of the photographs were made by the authors for the Imperial University of Japan, and are copyrighted in its name. They are printed on a fine Japanese paper, which is itself a product of the very district shaken by the earthquake. The book is published by Lane Crawford & Co., Yokohama, but the press-work was done in Tokyo. It is prepared as a popular souvenir of the earthquake, and makes no attempt at any scientific discussion of the phenomena, the ten pages of introductory letter-press on earthquakes in general and the short explanation attached to each plate being mainly descriptive.

In nearly one-third of the plates the objects illustrated are the temporary shelters to which the inhabitants were driven. But in those which illustrate the ruined condition of the buildings and bridges, the excellent plates give such perfect details that many points of scientific interest can be seen and studied. This is especially true of the series of five views of the Nagara iron railroad bridge. This bridge consisted of five two hundred-foot spans of trussed girders, of which one span fell entire into the river's bed, carrying down with it one end of each of the adjoining spans, yet the pictures make plain that the girders themselves were so well put together that they are but little injured by their fall. Another view shows the approach to this bridge, where the embankment has entirely sunk away, leaving the rails and ties eighteen feet up in the air. At another place where the rails have been distorted into a serpentine form, the photograph shows three distinct horizontal flexures in which the rails are at least two feet out of their alignment. Other views again illustrate the crevasses, often several feet wide, by which the ground was riven, especially

CALENDAR OF SOCIETIES.

Philosophical Society, Washington.

April 9.—W. J. McGee, Illustrations of Isostatic Pressure; Bailey Willis, Illustrations of Appalachian Structure (with lantern views); Robert T. Hill, The Geologic Evolution of the Topography of Texas (with lantern views).

Geographical Club, Philadelphia.

April 6.—Henry Pettit, The Orient and the Occident.

Contemporary Club, Philadelphia.

April 12.—Frank Hamilton Cushing, Zuni Folk-Lore.

Oriental Club, Philadelphia.

April 14.—Rev. Dr. Marcus Tastion, Psalms 24th, 73d, and 90th; Talcott Williams, Note on Arab Geography.

Numismatic and Antiquarian Society, Philadelphia.

April 7.—Inman Horner, Lieutenant Gorger's Notes on Alaskan Indians. Exhibition Alaskan Objects.

Publications Received at Editor's Office.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Transactions, Vol. VII. New York, The Institute. 8°. 647 p.

DAVIES, CHARLES. New Elementary Algebra. Edited by J. H. Van Amringe. New York, American Book Co. 12°. 294 p. 60 cts.

FERREE, BARR. Christian Thought in Architecture. New York, from the Proceedings of the American Society of Church History. 8°, paper. 23 p.

KELLER, HELEN. Souvenir of the First Summer Meeting of the American Association to Promote the Teaching of Speech to the Deaf. 2nd ed. Washington, Volta Bureau. 4°, paper.

NATURAL SCIENCE. Vol I., No. 1., March, 1892. London and New York, Macmillan & Co. Monthly. 8°. 80 p.

NEWALL, JANE H. Outlines of Lessons in Botany. Part II.: Flower and Fruit. Boston, Ginn & Co. 12°. 302 p. Ill.

PARSONS, JAMES RUSSELL, JR. French Schools through American Eyes. Syracuse, C. W. Bardeen. 8°. 126 p. $1.

PHILLIPS, MORRIS. Abroad and at Home. New York, Brentanos. 12°. 251 p.

SMITHSONIAN INSTITUTION. Annual Report of the Board of Regents to July, 1890. 8°. 842 p. Washington, Government.

Exchanges.

[Free of charge to all, if of satisfactory character. Address N. D. C. Hodges, 874 Broadway, New York.]

For sale or exchange, Das Ausland, 10 vols., 1828 to 1891, including 6 vols. bound, 4 in numbers. Wheeler Survey, vol. 1. Geog. Report; also vol. 6, Botany; Production of gold and silver in the United States, 1880, '1, '2, '3, '5; Selfridge Isthmus of Darien. Will sell at very low prices. J. F. James, 1443 Corcoran St., Washington, D. C.

For exchange.—A fine thirteen-keyed flute in leather covered case, for a photograph camera suitable for making lantern slides. Flute cost $27, and is nearly new. U. O. COX, Mankato, Minn.

To exchange: Experiment Station bulletins and reports for bulletins and reports not in my file. I will send list of what I have for exchange. P. H. ROLFS, Lake City, Florida.

Finished specimens of all colors of Vermont marble for fine fossils or crystals. Will be given only for valuable specimens because of the cost of polishing. GEO. W. PERRY, State Geologist, Rutland, Vt.

For exchange.—Three copies of "American State Papers Bearing on Sunday Legislation," 1891, $2.50, new and unused, for "The Sabbath," by Harmon Kingsbury, 1840; "The Sabbath," by A. A. Phelps, 1842; "History of the Institution of the Sabbath Day, Its Uses and Abuses," by W. L. Fisher, 1849; "Humorous Phases of the Law," by Irving Browne; or other works amounting to value of books exchanged, on the question of governmental legislation in reference to religion, personal liberty, etc. If preferred, I will sell "American State Papers," and buy other books on the subject. WILLIAM ADDISON BLAKELY, Chicago, Ill.

Wanted, in exchange for the following works, any standard works on Surgery and on Diseases of Children: Wilson's "American Ornithology," 3 vols.; Coues' "Birds of the Northwest" and "Birds of the Colorado Valley," 2 vols.; Minot's "Land and Game Birds of New England;" Samuels' "Our Northern and Eastern Birds;" all the Reports on the Birds of the Pacific R. R. Survey, bound in 2 vols., morocco; and a complete set of the Reports of the Arkansas Geological Survey. Please give editions and dates in corresponding. R. ELLSWORTH CALL, High School, Des Moines, Iowa.

To exchange Wright's "Ice Age in North America" and Le Conte's "Elements of Geology" (Copyright 1882) for "Darwinism," by A. R. Wallace, "Origin of Species," by Darwin, "Descent of Man," by Darwin, "Man's Place in Nature," Huxley, "Mental Evolution in Animals," by Romanes, "Pre-Adamites," by Winchell. No books wanted except latest editions, and books in good condition. C. S. Brown, Jr., Vanderbilt University, Nashville, Tenn.

For Sale or Exchange for books a complete private chemical laboratory outfit. Includes large Becker balance (accg. to 1-10mg.), platinum dishes and crucibles, agate motors, glass-blowing apparatus, etc. For sale in part or whole. Also complete file of *Silliman's Journal*, 1820-1885 (60-71 bound); Smithsonian Reports, 1854-1883; U. S. Coast Survey, 1854-1869. Full particulars to enquirers. F. GARDINER, JR., Pomfret, Conn.

Wants.

Any person seeking a position for which he is qualified by his scientific attainments, or any person seeking some one to fill a position of this character, be it that of a teacher of science, chemist, draughtsman, or what not, can have the 'Want' inserted under this head at 10 cents a count line. Nothing inserted at less than 50 cents a time prepaid by stamps, if most convenient.

TRANSLATOR wanted to read German architectural works at sight (no writing). One familiar with technical terms desired. Address "A.," Box 149, New York Post Office.

WANTED.—A position in a manufacturing establishment by a manufacturing Chemist of inventive ability. Address M. W. B., care of *Science*, 874 Broadway, N. Y.

WANTED.—Books on Anatomy and Hypnotism. Will pay cash or give similar books in exchange. Also want medical battery and photo outfit. DR. ANDERSON, 189 State street, Chicago, Ill.

WANTED.—A college graduate with some normal training, to teach the sciences, at $1,800 per year, in a Southern college. A Baptist or a Methodist preferred. Must also be a first-class Latin scholar. A. H. Beals, Box K, Milledgeville, Ga.

A PROFESSORSHIP in Chemistry is wanted by one who has had five years' experience in that capacity. Would prefer to give instruction by lectures and experiments rather than by text-book methods. Would like a position in a college or university where there is a good student's laboratory. Special points of strength claimed are: (1) Thorough control of a class and good order during lectures and recitations. (2) Accuracy in experimenting with chemicals and skill in the manipulation of chemical apparatus. The permission of several distinguished educators has been given to refer to them if required. Would not care to accept a position paying less than $1,500. Address B. E., care of *Science*, Advertising Dept., 47 Lafayette Place, New York.

ADDRESS WANTED.—Will some one please send the address of the Secretary of the American Philological Society. Also that of Herbert Spencer. "ADDISON," Room 84, 164 Madison St., Chicago, Ill.

ADDRESSES of Old Book Dealers wanted.—Wishing to obtain a number of old books out of print, I very much desire the addresses or catalogues of rare second-hand book dealers. If there is a directory or list of such dealers I should like to obtain possession of one. W. A. BLAKELY, Chicago, Ill.

WANTED.—(1) A white man versed in wood and iron working, able to work from specifications and plans, suited for an instructor of boys; his business to have charge of shops of school, outline and direct the work for foremen and students; salary to be $1,000 per annum (nine months). (2) A man (black preferred) to teach the colored, iron working and forging, subordinate to the preceding; salary, $720. (3) A man (white) competent to take classes in engineering (assistant's position), but with the ability to perform any of the work required in any of the ordinary engineering courses of our universities; salary from $1,000 to $1,500. A. H. BEALS, Milledgeville, Ga.

along the embankments of the rivers, and others the ruins of the cotton spinning mill at Nagoya.

Altogether this album of plates is a most valuable contribution to the history of the earthquake, and may well merit a place on the shelves of anyone interested in Seismology. The first edition of 1,000 copies has all been sold at 6 yen (about $4.50), which is a very low price for such a volume; and a second edition is in preparation, perhaps ready for issue by this time. This will contain one or two additional plates, and will be sold at a somewhat higher price.

C. G. R.

Princeton, April 9.

AMONG THE PUBLISHERS.

EDGERTON CASTLE'S important work on "Schools and Masters of Fence," which has heretofore only been obtainable in an expensive 4to form, will shortly be issued by Macmillan & Co. as a volume in the Bohn Library. The reprint will contain all the original illustrations and some additions in matter over the original work.

—G. P. Putnam's Sons add to their previous announcements the following: "Materialism and the Modern Physiology of the Nervous system," by William H. Thomson, M.D., professor of Materia Medica and Diseases of the Nervous System in the Medical College of New York. This volume, which will be illustrated, comprises the material (revised, with some additions) of two lectures recently delivered by the author before Columbia College, and at the McGill University, Montreal. Professor Freeman, whose sudden death a fortnight back has caused to be left unfinished a good deal of important literary work, had just before his death completed the proof-reading of the last pages of "The Story of Sicily," which he had prepared for the *Story of the Nations Series*. The preface to the volume, which he had not completed, will now probably be written by his son-in-law, Professor Arthur Evans.